

REMARKS

Claims 1 - 7, which were withdrawn under a restriction requirement have been cancelled. Applicants request that this cancellation be without prejudice, so that applicants can bring these claims in a divisional application.

Claim 26 is objected to because Claims 24 and 26 are cited by the Examiner as being identical. Applicants' attorney agrees that these claims are identical, due to amendment of the claim from which Claim 26 previously depended. Applicants have requested that Claim 26 be cancelled, this cancellation is requested to be without prejudice.

Claim Rejections Under 35 USC § 102

Claims 8 - 16 are rejected under 35 USC § 102(b) as being anticipated by U.S. Patent No. 5,039,388, to Miyashita et al.

Applicants respectfully contend that the Miyashita et al. reference does not anticipate (or render obvious) applicants invention as claimed in Claims 8 - 16. The Miyashita et al. reference permits formation of the electrodes either from aluminum having a purity of at least 99.0 % by weight or from aluminum alloys including JIS alloys which correspond with AA (U.S.) alloys 1050, 1100, 3003, 5052, 5083, and 6061. These alloys each contain different concentrations of the elements specified for applicants' high purity aluminum alloy. In most instances, the concentrations of such elements are higher than those specified by applicants. This indicates that Miyashita et al. did not consider the functional properties of the aluminum alloys which applicants consider to be critical to their invention. For example, the 6061 aluminum alloy which the Miyashita et al. reference says is acceptable contains 20 times more silicon, 4 times more copper, and 3 times more chromium than the maximum amount of

these elements which is permitted in applicants' aluminum alloy. The 5083 aluminum alloy which the Miyashita et al. reference says is acceptable contains about 47 times the maximum amount of manganese and more than 2 times the maximum amount of chromium which is permitted in applicants' aluminum alloy. The 5052 aluminum alloy which the Miyashita et al. reference says is acceptable contains more than 3 times the maximum amount of chromium which is permitted in applicants' aluminum alloy. The 3003 aluminum alloy which the Miyashita et al. reference says is acceptable contains 1.7 times the maximum amount of copper and more than 10 times the amount of manganese which is permitted in applicants' aluminum alloy.

This difference in teaching with respect to element concentrations which may be present in the alloy is critical, because such elements are among those defined as mobile elements by applicants, which mobile elements can agglomerate to form harmful particulates under process conditions which may be experienced by the component of semiconductor processing apparatus during the thermal cycling which is frequently experienced by the apparatus.

In addition to teaching that concentrations of particular elements which are critical to applicants' invention may be exceeded, the Miyashita et al. reference also teaches that "Particles composed of, for example, metallic silicon or an intermetallic compound such as β -AlFeSi, TiAl_3 , or MnAl_6 , are likely to form by crystallization or precipitation during manufacture of the material. As these particles are difficult to anodize, the base material used for making the electrode of this invention should not contain any such particles having a diameter exceeding two microns." This is in conflict with applicants' teachings that at least 95 % of all particles are 5 μm or less in size, no more than 5 % of the particles range between 20

μm and 5 μm, and no more than 0.2 % of the particles range between 50 μm and 20 μm.

Applicants are clearly teaching that up to 5 % of the particles may range between 20 μm and 5 μm, without reference to the composition of the particulates. The Miyashita et al. reference teaches that the aluminum alloy should not contain any particles having a diameter exceeding 2 μm, when the particles are made up of particular elements. This difference in teaching regarding the size of permissible particulates is due to a difference in functional properties which are considered to be critical. In the Miyashita et al. reference, the consideration is the difficulty in anodizing the particles (Col. 3, lines 45 - 49). In applicants' invention, the consideration is not how easy it is to anodize particles at the surface of the alloy, but how the particle size distribution at that surface (and throughout the substrate alloy) affects the uniform transition from alloy crystalline structure to oxide crystalline structure of the anodized layer (Specification, Page 8, lines 14 - 18).

In particular, applicants teach a high purity aluminum alloy having a given particulate size distribution within the alloy at the time the aluminum oxide layer is formed (Page 7, lines 18 - 23), combined with a given chemical composition of the aluminum alloy (Page 7, lines 8 - 17), provides a uniform transition from the high purity aluminum alloy to an anodized layer formed on the surface of the alloy. (Specification, Page 8, lines 14 - 18.) Further, applicants' disclosure teaches that the chemical composition of the aluminum alloy will determine the rate of formation of new particulates during the useful lifetime of the particular apparatus fabricated from the aluminum alloy. Process temperature cycling which occurs during the use of many semiconductor fabrication apparatus is to a sufficiently high temperature to permit migration of mobile impurities, as described by applicants in their Specification at Page 13, lines 16 - 27,

leading to the creation of agglomerations (particulates) which prevent a good interface from forming between a newly growing aluminum oxide film (at its base) and the underlying upper surface of the aluminum alloy. To reduce the rate of formation of new agglomerated particulates during use of the apparatus, and to thereby increase the useful lifetime of the apparatus, it is necessary for the aluminum alloy to have a particular composition.

The examples presented in the Miyashita et al. reference are illustrated with reference to aluminum alloys JIS 1050, 1100, 3003, 5052, 5083, and 6061, which correspond with the same numbering system in the U.S. Applicant has attached data sheets for these aluminum alloys which were obtained off the internet and which contain a limited amount of compositional information, but enough to show the differences between the composition of these alloys and applicants' high purity aluminum alloy. None of the Miyashita et al. alloys have the chemical composition and particulate content of the high purity aluminum alloy disclosed by applicants. The Miyashita et al. reference does not teach or even suggest a combination of the chemical composition and particle size distribution which applicants have specified to enable a uniform crystalline transition from the alloy surface to the oxide surface at the time of formation of the anodized layer, and which maintains integrity of the interface between the surfaces even after cycling of the semiconductor apparatus component through repetitive temperature cycles during the lifetime of the apparatus. When considering the useful lifetime of the apparatus, it is necessary to consider both the particle size distribution of particulates which are initially present in the substrate underlying the aluminum oxide layer, and also the mobile impurity content of the alloy which permits the formation of additional agglomerates/particulates during use of the apparatus. New particulates which form during the lifetime of the apparatus can migrate to the

interface with the aluminum oxide, disturbing the previously uniform transition from aluminum alloy to aluminum oxide, causing stress, fracture, and opening the possibility for chemical attack through the aluminum oxide layer. Applicants demonstrated (Page 20, lines 11 - 15 in their Specification) that a 6061 aluminum alloy, of the kind the Miyashita et al. reference indicated to be acceptable, failed to produce an alloy/oxide structure where the alloy is sufficiently protected by an anodized film from penetration by corrosive agents, while an alloy/oxide structure employing applicants' specialized alloy composition is protected. The Miyashita et al. test data pertains only to a change in thickness of the anodized layer after exposure to a plasma, and not to the ability of that anodized layer to prevent attack of the aluminum alloy underlying the anodized layer. (Col. 5, Table at lines 9 - 19.)

In light of the above distinctions and the amendment to independent Claim 8, applicants respectfully request withdrawal of the rejection of Claims 8 - 16 under 35 USC § 102(b), over Miyashita et al.

Claim Rejections Under 35 USC § 103

Claims 17, 20, 22, 28, 31, and 32 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Hisamoto et al. (US 6,066,392) and Miyashita (5,039,388).

Claim 17 pertains to a method of creating an aluminum oxide protective film on the surface of a high purity aluminum alloy of the kind disclosed by applicants. Claim 20, depends from Claim 17 (or 18, or 19) and adds a recitation that the aluminum oxide protective film which is formed exhibits hexagonal cells having internal pores ranging in size from about 300 Å to about 750 Å in diameter. Claim 22 also depends from Claim 17 (or 18, or 19) and adds a

recitation pertaining to the chemical composition of the high purity aluminum alloy which is being anodized. Claim 22 has been cancelled, since this compositional recitation has been added to Claim 17. Claim 28 pertains to a method of creating an aluminum oxide protective film over the surface of a high purity aluminum alloy having the particular chemical composition specified by applicants in independent Claims 8 and 13. Claim 31 depends from Claim 28 (or Claim 29, or Claim 30) and specifies the aluminum oxide formed exhibits hexagonal cells having internal pores ranging in size from about 300 Å to about 750 Å. Claim 32 depends from Claim 28 (or Claim 29, or Claim 30) and specifies the particle size distribution for particles in the high purity aluminum alloy, which includes particles of a size of greater than 5 µm.

Applicants respectfully contend that the combination of references cited does not render applicants' invention obvious because the individual references do not even suggest applicants' invention, and therefore a combination of these references cannot render applicants' invention obvious. In particular, the Miyashita et al. reference does not anticipate or render obvious applicants' invention for the reasons discussed above with respect to Claims 8 - 16. Since applicants' high purity aluminum alloy has been developed specifically to enable the formation of an oxidized layer on the aluminum alloy surface, use different substrates, such as those described in the combination of references cited, does not render applicants' invention obvious.

The Hisamoto et al. reference relates to an aluminum material having an anodic oxidation film applied. However, just as with the Miyashita et al. reference, the Hisamoto et al. reference claims that examples of a base aluminum alloy which can be used to form the corrosion resistant material include JIS 3003, 5052, and 6061 (Col. 6, lines 54 - 65).

Applicants have demonstrated that the use of 6061 aluminum alloy and similar alloys as a starting substrate prior to anodization does not provide the corrosion resistance provided when applicants' specialized high purity aluminum alloy is used as the substrate for anodization, as discussed with respect to the Miyashita et al. reference. A combination of the teachings of the Hisamoto et al. reference with those of the Miyashita et al. reference does not teach or even suggest applicants' invention. In fact, each of these references teaches away from applicants' invention.

In light of the above distinctions, the amendment to independent Claim 17, and the cancellation of Claim 22, applicants respectfully request withdrawal of the rejection of Claims 17, 20, 22, 28, 31, and 32 under 35 U.S.C. § 103(a) as being unpatentable over Hisamoto et al. (US 6,066,392) and Miyashita (5,039,388).

Claims 18 - 20, 22, and 29 - 32 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Hisamoto et al. and Miyashita et al., as applied to the claims above, in view of XP-002244144 (referred to XP'144).

Claim 18 depends from Claim 17 and pertains to a method of cleaning the aluminum alloy surface prior to the electrolytic oxidation process carried out in the method of Claim 17. Claim 17 specifically calls out both the chemical composition and the particle size distribution of applicants' high purity aluminum alloy which serves as the substrate for the electrolytic oxidation process. Claim 19 depends from Claim 18 and recites a deionized water rinse after the cleaning step of Claim 18. Claim 20 depends from Claim 17 (or 18, or 19) and pertains to the hexagonal cell pore sizes of the aluminum oxide protective film which is created in the

method of Claim 17. Claim 22 has been cancelled. Claims 29 - 31 are similar to Claims 18 - 20, but depend from independent Claim 28 which recites a method of creating an aluminum oxide protective film on the surface of a high purity aluminum alloy having a specialized chemical composition developed by the applicants. Claim 32 pertains to the method of Claim 28 (or Claim 29, or Claim 30) and recites the particle size distribution of mobile impurity particulates present in the high purity aluminum alloy. Again, this particle size distribution was developed by the applicants in combination with the chemical composition of the high purity aluminum alloy which serves as the substrate for the aluminum oxide film growth by electrolytic treatment.

This XP'144 reference is not identified as to source or date, but appears to be text taken from some general publication regarding aluminum, surface treatment of aluminum, and uses for aluminum. Applicants reserve the right to refute this reference as being one which is not applicable under 35 U.S.C. § 103(a) until the Examiner identifies the source of the printed matter and the date on which it was published.

The Hisamoto et al. and Miyashita references are deficient and fail to render applicants' invention obvious for the reasons provided above. The XP-144 reference appears to be a general reference which includes a description of surface treatment methods, including anodizing processes which can be used to convert an aluminum surface to aluminum oxide. Once again, the anodization processes are said to be applicable to a number of aluminum alloys, including 1100, 2011, 2014, 2017, 2024, 2117, 3003, 3004, 5005, 5050, 5052, 5056, 5357, 6053, 6061, 6063, 6151, and 7075, for example. It is not possible to cite the page number of the

article, on which these wrought alloys are listed, because there are no page numbers on the reference document.

Again, with respect to the XP '144 reference, as with respect to the Miyashita et al. and Hisamoto et al. references, there is nothing to suggest the use of a specialized aluminum alloy substrate having a particular chemical composition and mobile impurity particulate size distribution. There is no indication that there might be interface problems between the aluminum alloy substrate and the forming anodized layer if the alloys which are referenced are used as a substrate. While it might be obvious to try known treatment methods on any aluminum alloy surface, "obvious to try" is not the standard for obviousness under 35 U.S.C. § 103. "The mere need for experimentation to determine parameters needed to make a device work is an application of the often rejected obvious-to-try standard and falls short of the statutory obviousness of 35 U.S.C. §103." (*Uniroyal Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 5 U.S.P.Q.2d 1434 (Fed. Cir. 1988).) "An 'obvious-to-try' situation exists when a general disclosure may pique the scientist's curiosity, such that further investigation might be done as a result of the disclosure, but the disclosure itself does not contain a sufficient teaching of how to obtain the desired result or indicate that the claimed result would be obtained if certain directions were pursued." (*In re Eli Lilly & Co.*, 902 F.2d 943, 14 U.S.P.Q. 2d 1741 (Fed.Cir. 1990).) In the present instance, there is no suggestion that use of a specialized aluminum alloy substrate of the kind described and claimed by applicants will provide an improved transition from the aluminum alloy surface to the aluminum oxide layer which improves the performance of an anodized article, as claimed in Claims 17 and 28, and claims which depend therefrom.


Since none of the three references cited teach or even suggest the use of a specialized aluminum alloy of the kind described by applicants, where the surface of that alloy is treated in various manners and then electrolytically oxidized to provide an improved transition from the aluminum alloy surface to the aluminum oxide layer, a combination of these three references does not direct one skilled in the art toward applicants' invention.

In view of the above-described distinctions, and the amendment to independent Claims 17 and 28, applicants respectfully request withdrawal of the rejection of Claims 18 - 20, 22, and 29 - 32 under 35 U.S.C. § 103(a) as being unpatentable over Hisamoto et al. and Miyashita et al., as applied to the claims above, in view of XP '144.

Applicants contend that the claims as amended are in condition for allowance, and the Examiner is respectfully requested to enter the requested amendments and to pass the application to allowance.

The Examiner is invited to contact applicants' attorney with any questions or suggestions, at the telephone number provided below.

Respectfully submitted,


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